ICCES, 2024, vol.29, no.3
DOI: 10.32604/icces.2024.012234

PROCEEDINGS

Numerical Investigation on Blasting Failure and Impact Effects of Marine Launching Airbags

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ABSTRACT

Owing to uncontrollable deformation during the launching process, significant hazards such as airbag blast failure can be observed, which can cause severe damage to surrounding structures. Involving gas-solid coupling and nonlinear damage, the analysis and evaluation of airbag blasts are complex. Therefore, an effective method to analyze the possible blast behavior by coupling smoothed particle hydrodynamics (SPH) and the finite element method (FEM) has been presented in this study. First, a single airbag compression model was established to calculate the stiffness curve and the rationality of the numerical method was verified through comparison with experiments. Then, the Hashin failure criterion was introduced to analyze the fracture process of the membrane and the impact effect of jet. Finally, based on the developed in-house code, SPSLAS, two most dangerous states of airbag array launching: pier lifting and stern dropping, were analyzed. The results showed that an airbag blast often occurs first at the location where the hull bilge contacts, and the laminate at a certain angle to the axial direction is usually the first layer to be damaged. The jet was inclined upwards at an angle of approximately 45°. In addition, a potential blast hazard for some airbags may significantly increase stress response of the hull section. The result obtained could be used to improve the structure design of marine airbags for heavy structural transportation applications in ship and ocean engineering.

KEYWORDS

Marine airbag; blasting failure; SPH-FEM coupling method; fiber reinforced composite

Acknowledgement: Authors thank the support from Shangdong Nanhai Airbag Engineering Co., Ltd. who has contributed substantially to the completion of this study for their encouragement and experiment support.

Funding Statement: This work was funded by the Fundamental Research Funds for the Central Universities from the People's Republic of China.

Conflicts of Interest: The authors declare that they have no conflicts of interest to report regarding the present study.